Astrophysics Research And Analysis

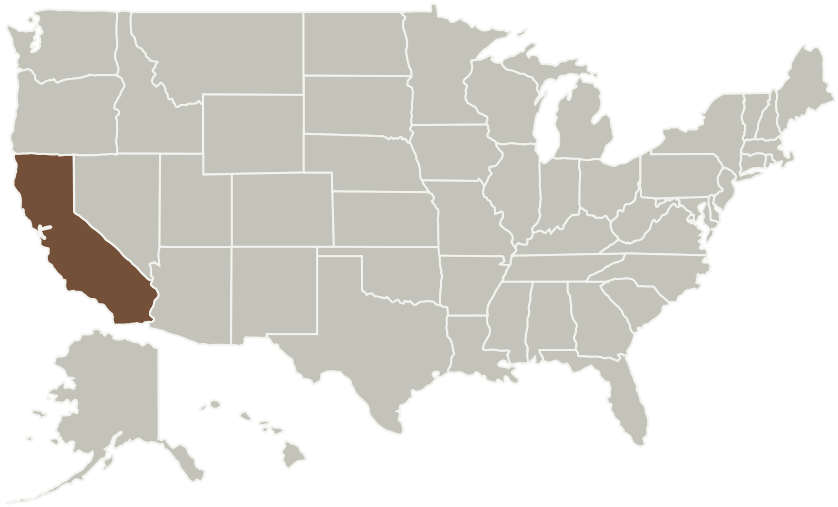
Optical frequency comb-based local oscillator phase noise cancellation in time-delay-interferometer for gravitational wave detection

Completed Technology Project (2015 - 2018)

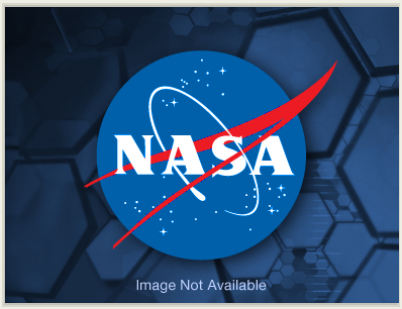
Project Introduction

Time-delay-interferometer (TDI) is well established as an effective technique to mitigate laser phase noises in laser interferometer gravitational wave detection (GWD). Just as important in the TDI scheme is the ability to suppress the rf local oscillator noise (LO) in the optical heterodyne measurements. We show that LO noises can be effectively and elegantly cancelled by employing optical frequency combs in which the rf signal phases are coherent with the optical phases. In addition, the deployment of optical combs eliminates the need for separate ultra-stable oscillators. This is a simpler and more reliable approach than the modulation scheme, and it can be applied to the most generalized TDI combinations. In this proposed effort, we will investigate the application of optical combs in TDI and demonstrate in a test bed simultaneous noise cancellations in both ranging lasers and rf LOs in a generalized TDI configuration.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
California Institute of Technology(CalTech)	Supporting Organization	Academia	Pasadena, California



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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Astrophysics Research and Analysis

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Primary U.S. Work Locations
California

Project Management

Program Director:

Michael A Garcia

Program Manager:

Dominic J Benford

Principal Investigator:

Nan Yu

Co-Investigators:

William Klipstein
Massimo Tinto
Karen R Piggee

Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.1 Optical Communications
    - TX05.1.6 Optimetrics

Target Destination

Outside the Solar System